Calc_Weekly Review 4_0910

1) ***Modeling Data*** The stopping distance of an automobile, on dry, level pavement, traveling at a speed v (kilometers per hour) is the distance R (meters) the car travels during the reaction time of the driver plus the distance B (meters) the car travels after the brakes are applied. The table shows the results of an experiment.

Speed, v	20	40	60	80	100
Reaction Time Distance, R	8.3	16.7	25.0	33.3	41.7
Braking Time Distance, B	2.3	9.0	20.2	35.8	55.9

a) Use the regression capabilities of your calculator to find a linear model for reaction time distance.

b) Use the regression capabilities of your calculator to find a quadratic model for braking distance.

c) Determine the polynomial giving the total stopping distance T.

d) Use your calculator to graph the functions R, B, and T in the same viewing window.

e) Find the derivative of T and the rates of change of the total stopping distance for $v = 40$, $v = 80$, and $v = 100$.

f) Use the results of this exercise to draw conclusions about the total stopping distance as speed increases.

2) ***Pendulum*** A 15cm pendulum moves according to the equation $\theta = 0.2\cos 8t$, where θ is the angular displacement from the vertical in radians and t is the time in seconds.

a) Determine the maximum angular displacement. Explain

b) Find the rate of change of θ when $t = 3$ seconds. Show work.

3) ***Wave Motion*** A buoy oscillates in simple harmonic motion $y = a\cos(bt)$ as waves move past it. The buoy moves a total of 3.5 feet (vertically) from its low point to its high point. It returns to its high point every 10 seconds. Use the water's surface as the midline.

   a) Write an equation describing the motion of the buoy if it is at it high point at t = 0. (If you need help, see my wiki under Trig → Trig_Basics_Ch3&4 or click the link: http://mrwing.wikispaces.com/file/view/Trig_Basics_Ch3%264_0910.pdf)

   b) Determine the velocity of the buoy as a function of *t*.

4) ***Temperature Change*** The average temperature in Fairbanks, Alaska, during a typical 365-day year is given by the equation $y = 37\sin\left[\frac{2\pi}{365}(x - 101)\right] + 25$ where *y* is the temperature in Fahrenheit and *x* is the day of the year.

   a) On what day is the temperature increasing the fastest?

   b) About how many degrees per day is the temperature increasing when it is increasing at its fastest?

5) ***Particle Motion*** The position of a particle moving along a coordinate line is $s = \sqrt{1 + 4t}$, with *s* in meters and *t* in seconds. Find the particle's velocity and acceleration at *t* = 6 seconds.

Answers to Calc_Weekly Review 4_0910

1)

a) $R(v) = 0.417v - 0.02$
b) $B(v) = 0.0056v^2 + 0.001v + 0.04$
c) $T(v) = 0.0056v^2 + 0.418v + 0.02$
d) Graph it
e) $T'(v) = 0.0112v + 0.418$; $T'(40) \approx 0.866$; $T'(80) \approx 1.314$; $T'(100) \approx 1.538$
f) Answers will vary

2)

a) Max is 0.2 radians
b) 1.45 rad/sec.

3)

a) $s(t) = 1.75cos\left(\frac{2\pi}{10}t\right)$
b) $v(t) = -0.35\pi sin\left(\frac{2\pi}{10}t\right)$

4)

a) Day 101
b) About 0.64 deg/day

5)

a) $v(6) = 0.4$ m/sec.
b) $a(6) = -0.032$ m/sec^2